REINHOLD ENVIRONMENTAL Ltd.

2015 APC Round Table & Expo Presentation

July 13 & 14, 2015, in Atlanta, GA / Hosted by Southern Company

Reduction of Carbon Dioxide Emissions from Existing Coal-Fired Boilers

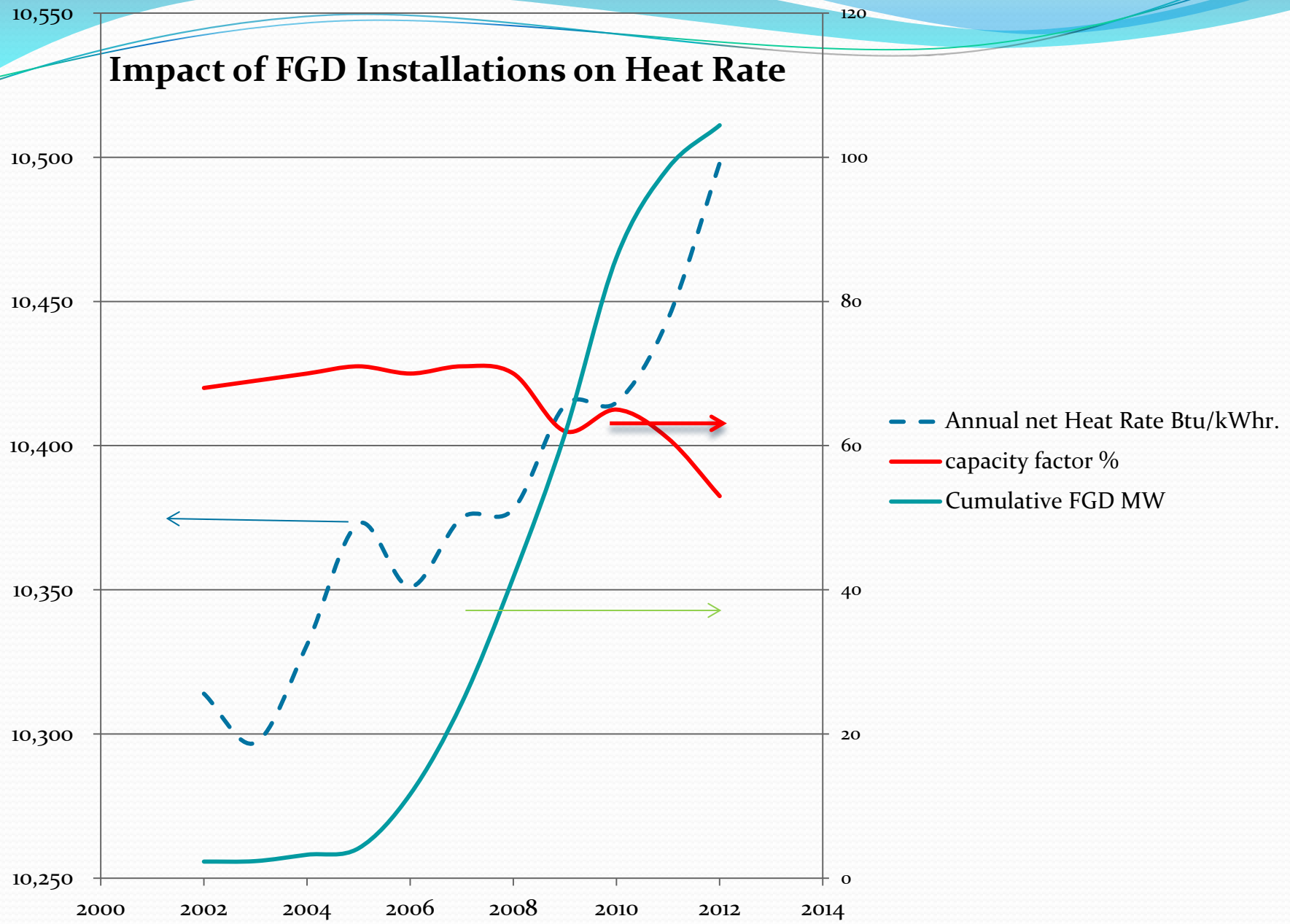
Presented by
Tony Licata
Licata Energy & Environmental Consultants, Inc.
James Staudt, PhD
Andover Technologies Partners

CO_2 Reduction through heat rate improvements

- EPA suggests average 6% improvement in heat rate of coal fired plants is achievable EPA indicates that the average heat rate of the ten year period between 2002 and 2012 for the over 800 units that the data was based on varied between 9,924 Btu/kWh and 9,643 Btu/kWh for an 11 year average of 9,754 Btu/kWh.
- Statistical analysis based on gross heat rate, ambient temperature and hourly average load expressed as a percent of maximum.

Reality

- EPA did not consider any technical aspects of the facility, or if any characteristics changed over the 11 year period of time, including changes in operating mode (switching from base load to cycling), retrofits (installation of low NOx burners, SCRs, or FGD), or if the facility changed coals over this period, or any characteristics of the fuel for that matter. EPA also did not compare units against one another or do any sort of sub-categorization
- Hire a statistician to tell you what you want to hear.

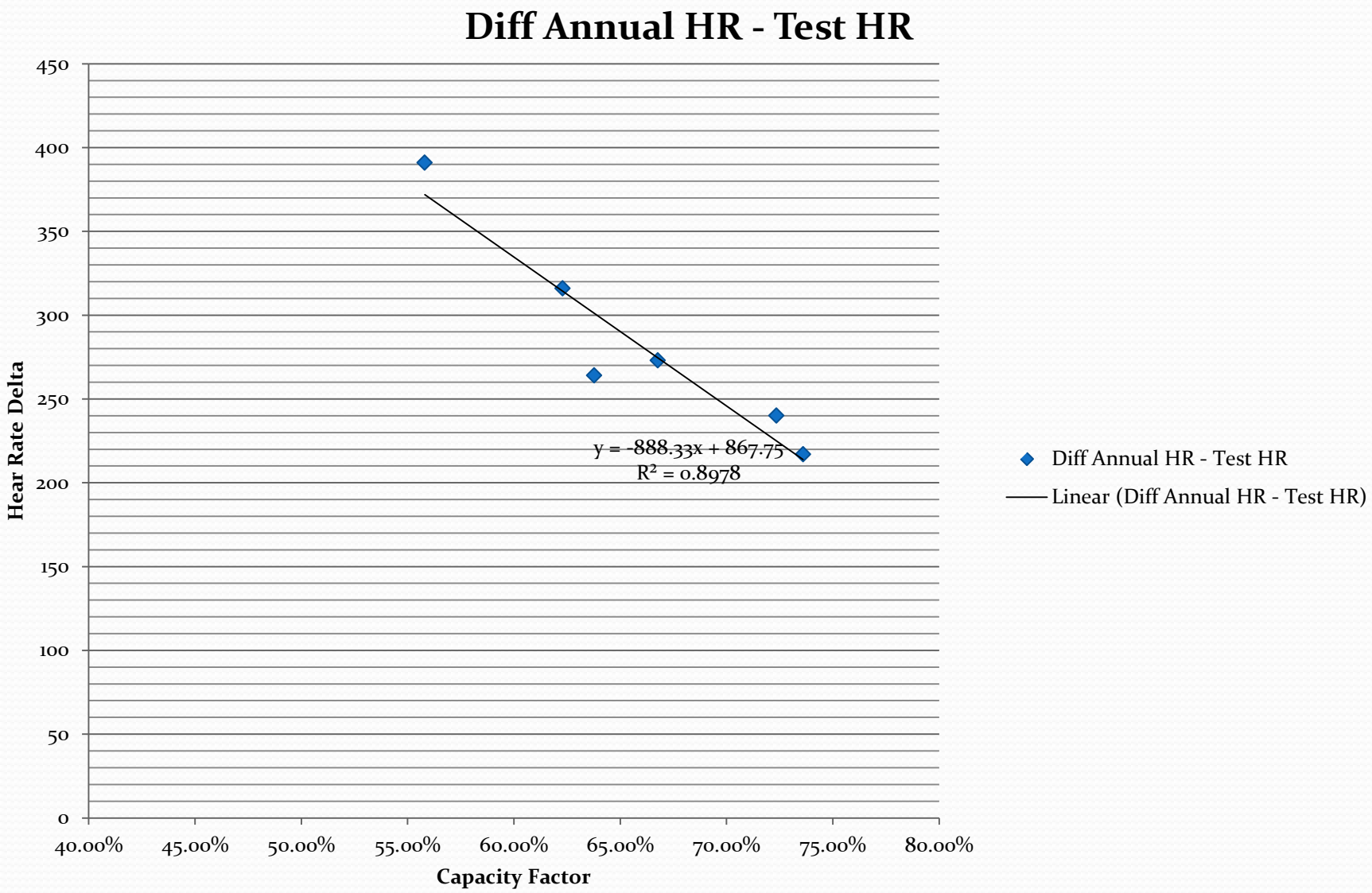

Impact of FGD Installations on Heat Rate
10,550
10,500
10,450
10,400
10,350
10,300
10,250
120
100
80
60
40
20
0
2000
2002
2004
2006
2008
2010
2012
2014
Annual net Heat Rate Btu/kWhr.
capacity factor %
Cumulative FGD MW

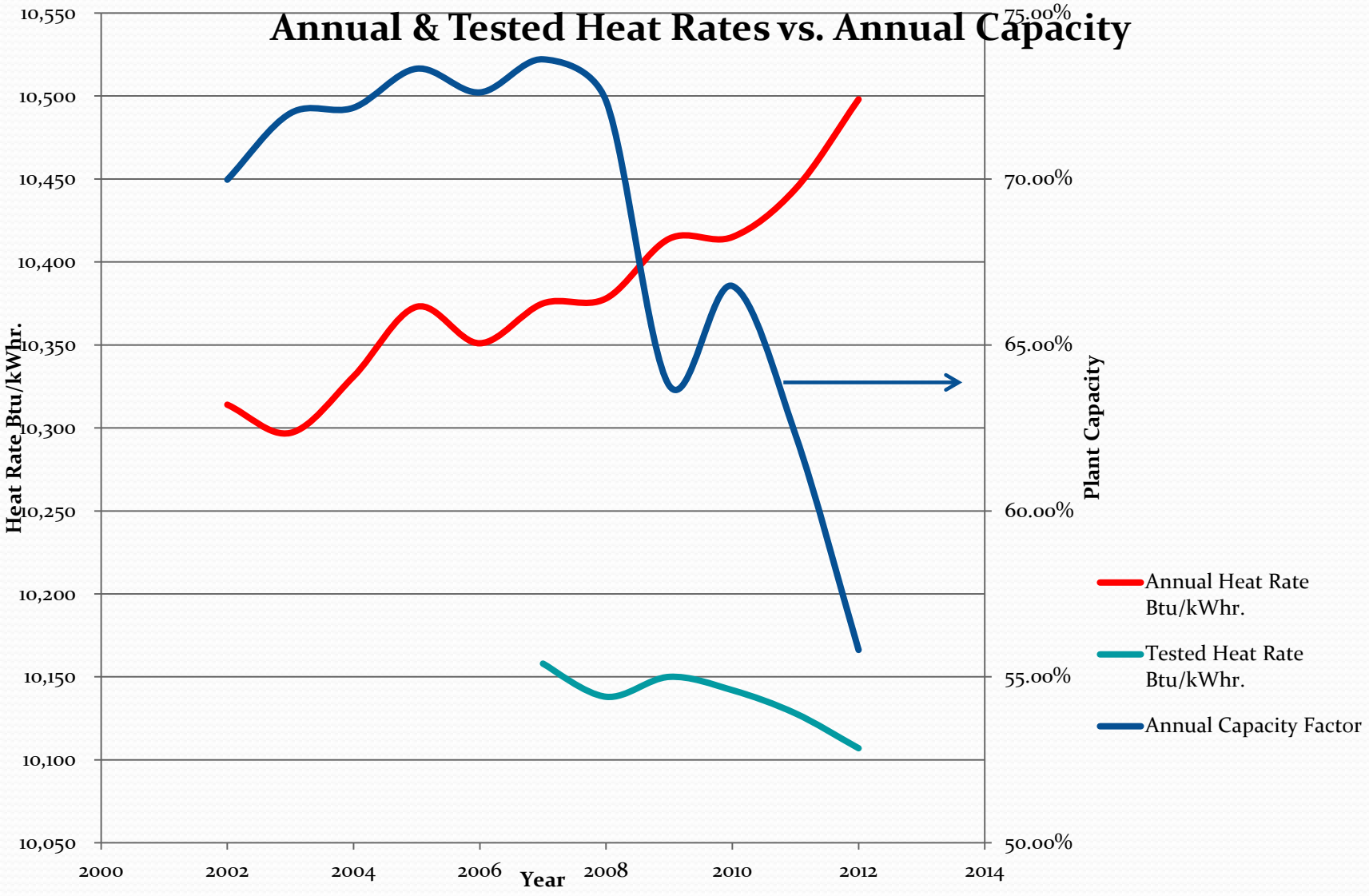
Impact of Boiler Type & Coal vs. HR

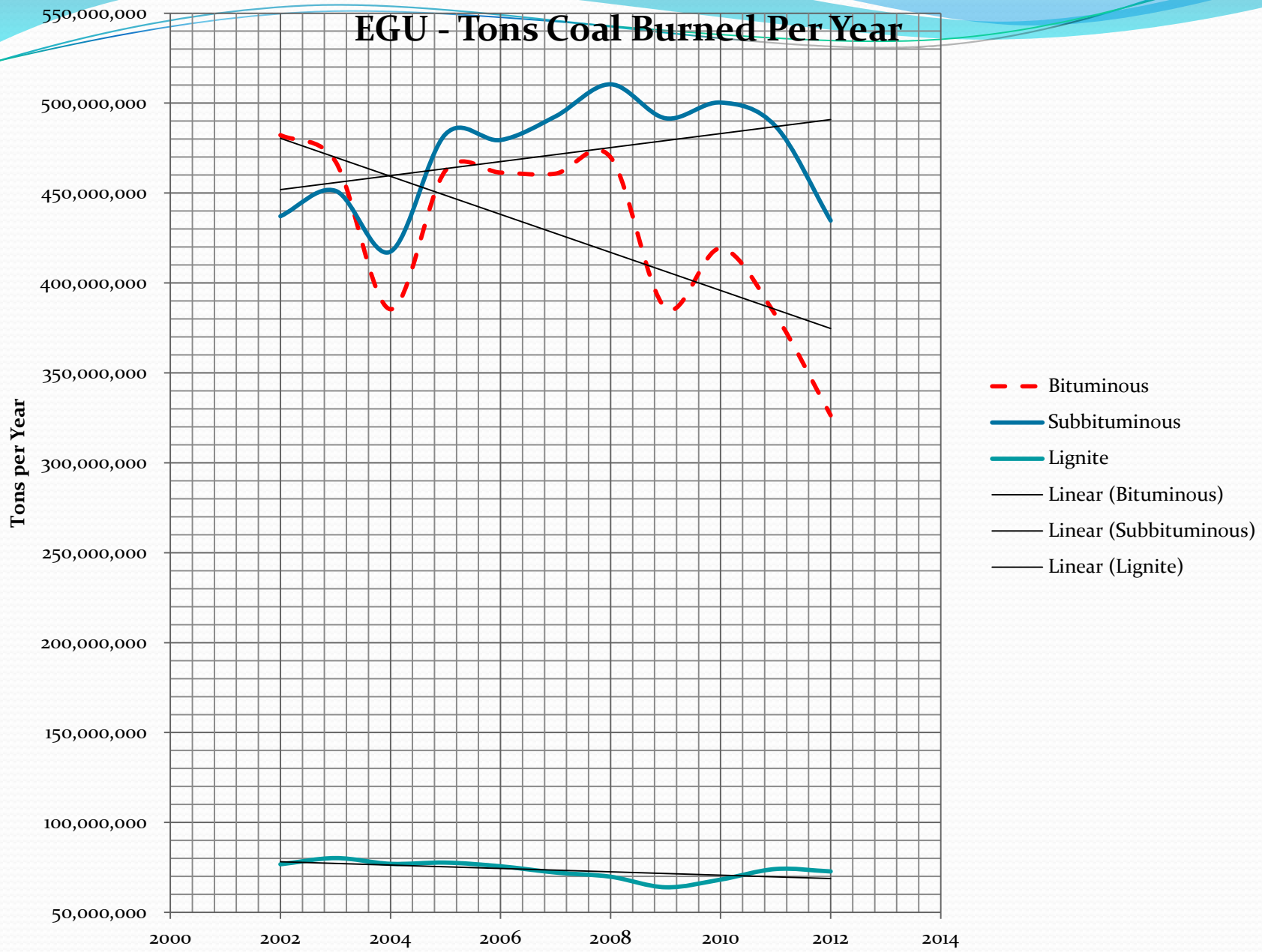
	Subcritical HR		Supercritical HR	
	Bituminous	Subbituminous	Bituminous	Subbituminous
100-200 MW	10,663	11,051		
200-500 MW	10,470	10,642	10,364	
500+ MW	10,121	10,374	9,868	10,582
Lignite	11,091			

Heating Values of Coals in Electric Generation						
Year	2008	2009	2010	2011	2012	2013
All coals	9,918	9,878	9,817	9,738	9,650	9,675
Lignite	6,495	6,427	6,474	6,513	6,479	6,509
Subbituminous	8,699	8,698	8,693	8,699	8,721	8,753
Bituminous	11,970	11,951	11,952	11,886	11,813	11,722

year	Annual Capacity Factor	Annual Heat Rate Btu/kWhr.	Tested Heat Rate Btu/kWhr.
2002	69.98%	10,314	
2003	71.98%	10,297	
2004	72.15%	10,331	
2005	73.32%	10,373	
2006	72.61%	10,351	
2007	73.60%	10,375	10,158
2008	72.35%	10,378	10,138
2009	63.78%	10,414	10,150
2010	66.78%	10,415	10,142
2011	62.30%	10,444	10,128
2012	55.81%	10,498	10,107


Diff Annual HR - Test HR
Hear Rate Delta
450
400
350
300
250
200
150
100
50
0
40.00%
45.00%
50.00%
55.00%
60.00%
65.00%
70.00%
75.00%
80.00%
Capacity Factor
y = -888.33x + 867.75
R² = 0.8978
Diff Annual HR - Test HR
Linear (Diff Annual HR - Test HR)


Annual & Tested Heat Rates vs. Annual Capacity
10,550
10,500
10,450
10,400
10,350
10,300
10,250
10,200
10,150
10,100
10,050
Heat Rate Btu/kWhr.
75.00%
70.00%
65.00%
60.00%
55.00%
50.00%
Plant Capacity
2000
2002
2004
2006
2008
2010
2012
2014
Year
Annual Heat Rate Btu/kWhr.
Tested Heat Rate Btu/kWhr.
Annual Capacity Factor


EGU - Tons Coal Burned Per Year
Tons per Year
550,000,000
500,000,000
450,000,000
400,000,000
350,000,000
300,000,000
250,000,000
200,000,000
150,000,000
100,000,000
50,000,000
2000
2002
2004
2006
2008
2010
2012
2014
Bituminous
Subbituminous
Lignite
Linear (Bituminous)
Linear (Subbituminous)
Linear (Lignite)

Impact of Coal Rank on Heat Rate